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# USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 116

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26 September 1983

USSR REPORT  
ELECTRONICS AND ELECTRICAL ENGINEERING

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UDC 621.385.832.7:621.397.132

ERROR OF KTTs-5.048 COLORIMETER IN MEASUREMENT OF CHROMATICITY OF KINESCOPE SCREEN

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 83 pp 46-48

ALEKSANDROVA, I. G., Moscow Scientific Research Institute of Television

[Abstract] The KTTs-5.048 digital television colorimeter is used for measuring the chromaticity of color television screens. Its absolute error must be determined upon delivery from the factory and during subsequent periodic inspections. Such a determination has been made during actual measurement, by comparison of its readings with those of a C2000 colorimeter manufactured by "Lichtmesstechnik" in West Berlin. Reference measurements were performed on at least 26 chromaticity etalons and control measurements were performed at 48 points on a kinescope screen. The results have been processed according to a special computer program, taking into account that the C2000 measuring head has a window 64 mm in diameter while the KTTs-5.048 instrument covers a spot 20 mm in diameter. Five factory-produced KTTs-5.048 units were tested for measurement error according to this procedure, the results indicating that the error of this instrument is within the acceptable limits of  $\pm 0.015$  for each color coordinate. Figures 1; tables 2; references 3: 2 Russian, 1 Western. [290-2415]

## LINE-SEQUENTIAL TRANSMISSION OF COLOR-DIFFERENCE SIGNALS IN DIGITAL TELEVISION

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 83 pp 44-46

KHLEBORODOV, V. A., All-Union Scientific Research Institute of Television and Radio Broadcasting

[Abstract] Nonbinary 3:1 coding with subsequent line-sequential transmission of two color-difference signals in digital television is analyzed, for the purpose of evaluating the proposed 3:1 standard relative to the 4:2:2 coding standard in accordance with CCIR 601. A resultant 108 Mbit/s flux of digital signals  $10.125 \times 8$  (brightness) +  $3.375 \times 8$  (color difference) and the image structure in the vertical-time domain are traced through discretization and quantization with Fourier transformation. Theoretical calculations are made for the red difference signal, but they apply to the blue difference signal as well. The analysis of line-sequential transmission of a stationary image with a frame cycle according to the 3:1 standard reveals discretization noise in the form of moires in the spectral components superposed vertically and in time. This noise can be eliminated only by narrowing of the vertical frequency range to less than one fourth, through prefiltering and post-filtering. Figures 4; references 5: 4 Russian, 1 Western. [290-2415]

UDC 621.397.3

## BUFFER MEMORY FOR SINGLE LINE

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 83 pp 52-53

YELFIMOV, O. Ye., FELIK, V. V. and YAKIMOV, V. A.

[Abstract] A buffer memory for digital processing of a single line in a television image is described, a device indispensable for such processing before and after transmission of images over narrow-band communication channels. It facilitates search for a selected image line in real time, with its fast recording and slow readout. Its capacity is 512 elements, its control module being designed for selecting 512 active lines in a frame: 256 in the odd field and 256 in the even field. It is synchronized by external quench pulses of 15,625-Hz line frequency and 50-Hz field frequency, also by "fast/slow operation" clocking pulses. The hardware of this device includes a direct-access memory with address selector, five gates, four counters, three decoders, two triggers, five pulse shapers, a field discriminator, three commutator switches, a code coincidence circuit, and a transcript resolver. The device is built with extensive use of series 155 integrated microcircuits, 32 chips for a 2-gradation input signal and 46 chips for an 8-digit input signal. Figures 1; references: 5 Russian. [290-2415]

## TELEVISION-MOVIE PROJECTION ROOM AT TOMSK RADIO TELEVISION CENTER

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 7, Jul 83 pp 55-56

POBEREZHNY, N. I., Tomsk Radio Television Center

[Abstract] A room at the Tomsk Radio Television Center has been equipped for projecting color television movies, a significant step toward conversion from black-and-white to color television transmission. The facilities include "Rayon" projecting equipment, a holdover from black-and-white projecting facilities and consisting of three SKP-37 35-mm projectors which operate sequentially with automatic control. The projector which has been operating most intensely during a 24-hour period is checked out according to applicable specifications and is transferred to reserve status until the next projector replaces it. This ensures the most nearly uniform burdening of all three, with assurance of maximum life and reliability. In addition, there have been installed a TK-16 16-mm projector and three KT-116 color television cameras mounted on top of existing K-59 cameras. The optical components of "Rayon" or "Gorod" equipment have been retained: five Zh-26 objectives (three for the three SKP-37 projectors, two on "Raduga" adapters and with diaphragms for the two KT-116 cameras), one OKS-75 objective (for the TK-16 projector), two congruence prisms, one rotatable cube-prism regulating the two KT-116 cameras, one collective lens, and three rotatable plane mirrors. A major problem is the light source, K30x400 lamps operating at reduced voltage of 28-29 V having been found to offer the best tradeoff between spectral characteristics and reliability. Experience has shown that the gamma-correction factor should be reduced from 0.6 to 0.4 and LI 432 tubes should be used in the cameras. Figures 2.

[290-2415]

## SOUND EQUIPMENT IN 'V. I. LENIN' SPORTS AND CONCERTS COMPLEX IN LENINGRAD

Moscow TEKHNIIKA KINO I TELEVIDENIYA in Russian No 7, Jul 83 pp 6-13

LITVINOV, V. Ye., Central Design Office of Cinematography, "Ekran" Scientific-Industrial Association

[Abstract] The "V. I. Lenin" sports and concerts complex in Leningrad, opened to the public in 1980, is a covered circular general-purpose sports field (160 m in diameter) containing a 124-88 m large arena asymmetrically surrounded by galleries with a total capacity of 25,000 seats. The KZTU5 sound equipment installed in this complex provides audio amplification during concerts, voice amplification during sport meets and exhibition games, reproduction of phonograms for replay of filmed sequences, and distribution of unmonitored signals to the media. The sound equipment covers 60 microphone channels, 32 to the



main hall with 16 amplifier units and 10.4 kW power and 28 with 3.6 kW power to five lobbies. The audio-frequency range is 30-15,000 Hz, with a maximum ripple factor of 2% and a signal-to-noise ratio of 70-80 dB. The basic components are a 100K37 monitor console, 50U135 and 50U261 amplifier bays for the main hall and the lobbies respectively, microphone and line switching panels, power distribution panels, intermediate panels for incoming and outgoing lines, microphone and loudspeaker hookup panels, a "Za1" ("Hall") 100K35 monitor panel for sound recording, and a phonogram reproducer for film replay. There are 6-400 loudspeakers, condenser-type and dynamic microphones, and radio microphones. The sound is wired in a radial-circular pattern, with the field and the galleries subdivided into sectors and zones. The monitor consoles are of modular construction, with three sections: the two outer sections with 10 input and 3 output cassettes each and the center section with 12 input and 3 output cassettes. Among the channels monitored through cassettes are aggregate channels, a sound-effects channel, a movie-picture channel, two reverberation channels and one "echo chamber" channel. The sound equipment meets the requirements for sports and music events, but should be further improved at all levels during corrective adjustments of hall acoustics (additional sound proofing). Figures 5; references: 1 Russian.  
[290-2415]

UDC 681.84.083.8:621.3.037.372

#### DIGITAL MAGNETIC RECORDING OF SOUND

Moscow TEKHNKA KINO I TELEVIDENIYA in Russian No 7, Jul 83 pp 13-20

ARNOL'D, R. R., All-Union Scientific Research Institute of Cinematography

[Abstract] The principles of digital magnetic sound recording are demonstrated in a conversion of an analog simple harmonic audio signal to a digital one during high-speed recording of a continuous process of "live" moving image. Both discretization and quantization, with subsequent binary encoding of quantization levels, are examined from the standpoint of compatibility with television video and audio channels. Relative merits of linear and nonlinear quantization are weighed, and various quantization codes are compared: NRZI (Non-Return to Zero Inverted), MFM (Modified Frequency Modulation), 3PM (Three-Position Modulation), HDM (High-Density Modulation). [These codes are given in English]. Operating and performance characteristics of digital magnetic sound recorders are compared with those of analog ones, with emphasis on advantages as well as disadvantages of each type. The basic electromagnetic parameters of the recording-and-playback channel are defined and their dependence on the parameters of the digital signal is established. Technical data on various commercially available digital magnetic sound recorders with oblique line-sequential recording (Sony, EIAJ) or with stationary head (Mitsubishi, 3M, Ampex, Sony) are given for comparative evaluation. Figures 5; tables 4; references 18: 5 Russian, 13 Western.  
[290-2415]

## 'KOS-2' ILLUMINATOR FOR SPECIAL FILMING OPERATIONS

Moscow TEKHNICA KINO I TELEVIDENIYA in Russian No 7, Jul 83 pp 29-31

ALFIMOVA, N. V., KRIVOSHEY, L. N., KURITSYN, A. M., OSKOLKOV, I. N. and POKHITONOV, Yu. P., All-Union Scientific Research Institute of Cinematography

[Abstract] A high-intensity low-heat illuminator has been developed for scientific-popular and scientific-research high-speed macrofilming. This KOS-2 illuminator consists of 12 luminaires uniformly spaced adjacent to one another around the inside of a ring which has an outside diameter of 450 mm. Each luminaire consists of a KGM 30-300-2 or KGM 24-250 lamp, an interference-type reflector, a heat filter made of SZS glass and a scatterer made of frosted glass. The optical axes of these luminaires are all at a  $45^\circ$  angle to the axis of the ring assembly and they meet on that axis at a point 0.3 m away from the output aperture at the center of the ring. The total power of the lamps is 3600 W. The illuminance of an object can be regulated from a minimum to the maximum of 29,000 lx at the focus on the ring axis, with fast transition from one level to another and with individual turning-on of each luminaire. The illuminator operates from a 220 V line through a thyristor-regulated PT voltage supply. The luminaire ring, mounted in a yoke with an arm clamped to a stand, can be moved vertically through 830 mm and horizontally through 320 mm. It can also be rotated through  $180^\circ$  in both vertical and horizontal planes. Remote control is possible from distances up to 5 m. Figures 8; tables 1; references: 4 Russian.

[290-2415]

## QUANTITATIVE EVALUATION OF QUALITY OF LIGHT-SENSITIVE AND MAGNETIC RECORDING MEDIA

Moscow TEKHNICA KINO I TELEVIDENIYA in Russian No 6, Jun 83 pp 17-19

ARAKELYAN, V. S., NEMTSOVA, S. R., OLEFIRENKO, P. P. and SOROKIN, M. M., State Scientific-Research and Design Institute of the Chemico-Photographic Industry

[Abstract] A generalized quality indicator is proposed for evaluation of light-sensitive and magnetic data recording media. The disadvantage of additive weighing is that, while the arithmetic mean is high, a significant component indicator could be below the acceptable level. The disadvantage of multiplicative weighing is that the geometric mean could unnecessarily fall below the acceptable level only because of a low secondary component indicator. In the proposed method of weighing all indicators are subdivided into two groups of significance, namely governing ones and supplementary ones. The corresponding generalized quality indicator  $Q$  is the geometric mean of two group indicators, the first being the weighted arithmetic mean of all indicators and the second

being the weighted geometric mean of only the governing ones. The requirement that  $0 \leq Q \leq 1$  is satisfied automatically when  $q_i = (P_i - P_{i0}) / (P_{ir} - P_{i0}) \leq 1$  ( $P$  - value of  $i$ -th indicator for tested material,  $P_{ir}$  - value of  $i$ -th reference indicator,  $P_{i0}$  - limit value of  $i$ -th indicator,  $i = \overline{1, n}$ ,  $n$  - number of normalized indicators) and thus upon correct selection of the reference specimen. This principle was used for evaluating various grades of magnetic tape (Soviet-made A4615-6R, A4414-6R, A4409-6B, A4408-6B, A4407-6B, A2601-6R as well as LGR-50 produced by BASF GmbH in West Germany), after specimens had been tested according to GOVERNMENT Standard 21887-76 for governing indicators (M frequency characteristics, nonlinear distortion factor, relative noise level after magnetization) and supplementary indicators (nonuniformity of sensitivity at 400 Hz, relative noise level during pause, relative level of duplication effect) at a nominal recording density of 320 nbit/m, with A4403-6 "typical" tape material as reference. Figures 1; tables 1; references: 14 Russian. [269-2415]

UDC 778.53:771.531.352"Kinor 16R"

#### 'KINOR 16R' PORTABLE MOVIE CAMERA

Moscow TEKHNIKA KINO I TELEVIDENIYA in Russian No 7, Jul 83 pp 21-22

BORISOV, Ye. N., BYCHKO, Ye. G. and GORDEYEV, V. F., Moscow Design Office of Movie Equipment

[Abstract] A low-noise portable television movie camera has been developed for 16-mm film. The kinematic system of this "kinor 16R" camera has been reduced to utmost simplicity and minimum number of elements. Noise generating gears have been eliminated and the ratchet mechanism is mounted on the same shaft as the mirror-type lateral shutter. For operation, the film cassette is tilted upward in order to be parallel to the shutter shaft and thus inclined at  $45^\circ$  to the optical axis. The shutter has a  $180^\circ$  aperture angle, the rotatable lens has a 10:1 magnifying power. The ratchet, with a counter-ratchet, has been designed with precision which ensures high picture quality at any speed within the wide range of 8-64 frame/s. The camera is equipped with a built-in exposure meter, and the electric drive motor is quartz stabilized for synchronous operation at filming speeds of 24 or 25 frames/s. The cassette can carry 120 m of film, and the entire camera weighs 7 kg and is operational at temperatures from  $-30$  to  $+40^\circ\text{C}$ . Figures 3; tables 1; references: 2 Russian. [290-2415]

## DEVICE FOR OUTPUT STABILIZATION OF TELEVISION TRANSMITTER PARAMETERS

Moscow VESTNIK SVYAZI in Russian No 6, Jun 83 pp 31-35

FRIDMAN, E. M., chief of Central Laboratory, All-Union Radio Television Transmitting Station imeni 50-Letiya Oktyabrya, SHELEPEN', I. V., chief specialist, CHALENKO, V. L., senior engineer, and KOROTYCHEV, V. I., senior engineer

[Abstract] Activity at the Central Laboratory of the All-Union Radio Television Transmitting Station imeni 50-Letiya Oktyabrya, with participation of specialists from the USSR Television Network, includes modernization with automation of the television broadcasting equipment. Typical practical results are the introduction of transistorized multilateral precorrectors and transistorized modulator-correctors in "Zona-1", "Yakor'" and other transmitters. Distortion of the picture-carrying radio signal transmitted over long distance is caused by deviations from normal levels, low-frequency interference, and deformation of the synchronizing mix. A possible remedy is input and output stabilization, the latter by means of special feedback arrangements. The device for output stabilization, recently developed at the Central Laboratory, incorporates means of stabilizing the radio signal with respect to quench level and sweep of synchronizing pulses as well as prevention of relative premodulation and compensation of background interference. It also includes an interference-immune automatic regulation system with an automatic selection of operating mode. Its essential functional components are a controlled limiter, a filter establishing the upper cutoff frequency, two controlled amplifiers, a controlled restorer of the center component in the video signal, an electronic potentiometer, and two shaping circuits: one for the interference compensation signal and one for the premodulation prevention signal. All components of this device use transistors, and operational amplifiers where appropriate. The device has been tested in actual operation together with the picture channel of a "Yakor'" transmitter and TRSA relay equipment. The results were positive, indicating the possibility of maintaining characteristic levels in the radio signal according to GOvernment STandard 7845-79 1.4.2 with the background interference reduced to -46 dB. Figures 9. [289-2415]

UDC 621.315.212.029.5.001.24

CHARACTERISTICS OF COAXIAL RADIO-FREQUENCY CABLE WITH SHIELD OF METALLIZED FILM

Moscow ELEKTRICHESTVO in Russian No 6, Jun 83 (manuscript received 25 Nov 82)  
pp 65-68

KARAMYAN, S. G. and ZEL'TSBURG, B. A., All-Union Scientific Research Institute of the Cable Industry, Yerevan Department

[Abstract] A shield of metallized polymer film can be wrapped around a cable up to sixty times faster than shield of copper braid, the shielding factor also being 25-30 dB higher and at least 15 kg/km of copper saved as a result. These data are based on an experimental shield for a coaxial r-f cable, consisting of a 0.02-mm thick polyethylene terephthalate film with 0.03-mm thick bilateral aluminum foil metallization. The electrical characteristics of a coaxial r-f cable with such a shield are calculated, taking into account the geometry of the lap joint with the unavoidable tapering gap underneath the shield along the cable. The propagation of an electromagnetic wave along the dielectric (polymer) interlayer and the field in the latter are calculated according to the theory of analytic (harmonic) functions of the complex variable, in two successive approximation: 1) First assuming a negligible impedance of the cable conductors (inner wire conductor and outer foil conductor separated by thick cylindrical layer of insulation) and treating them as superconductors, and 2) Then accounting for a limited penetration of the external field into the conductors to a finite skin depth. The thickness of the metallized polymer shield is, furthermore, assumed to be much smaller than the outside radius of the cable. On the basis of the analytical relations for the field potential and intensity, the thicknesses of the polymer interlayer and metal foils are then selected for optimum shielding characteristics. The field around the lap joint of the shield is of special concern on account of distortion and additional power loss. The results of analysis and calculations reveal that, with a sufficiently thin polymer interlayer, such a shield provides adequate electromagnetic interference immunity without significant distortion of the field of the cable at the lap joint. The power loss is somewhat higher than in a copper braid, however, because of the higher resistance of a metallized polymer. Figures 2; references: 6 Russian.  
[292-2415]

# ANALYSIS OF INTERACTION OF TERMINAL JUNCTIONS WITH MESSAGE SWITCHING CENTER

Moscow VESTNIK SVYAZI in Russian No 6, Jun 83 pp 27-29

SHESTOPALOV, A. M., candidate of technical sciences, department head, Institute for Upgrading Managers and Specialists, USSR Ministry of Communication, and KLEPIKOV, V. P., individual contributor, Central Scientific Research Institute of Communication

[Abstract] The performance of the message switching center at a USSR Central Telegraph Office is analyzed in terms of its interaction with terminal junctions. This interaction is checked and controlled by means of various codograms, while the state of channels and their performance are reported through various kinds of service communications. Here statistical data on transmission of five codograms and eight kinds of service communications are evaluated. The statistical characteristics thus established and the known technical characteristics of a message switching center serve as a basis not only for predicting the quality of telegrams processing operation, in terms of speed and delay, load capacity, errors and distortions, but also for recommending ways to improve this operation. Practical experience in the Moscow Central Telegraph Office confirms the validity of this analysis and such recommendations. Figures 2; tables 5.  
[289-2415]

DEPENDENCE OF CURRENT CAPACITY OF SUPERCONDUCTOR WINDINGS OF ELECTROMECHANICAL DEVICES ON WIRE SIZE

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 5, May 83 (manuscript received 25 Mar 81) pp 104-108

ANDRIANOV, V. V., candidate of technical sciences, director of laboratory, BAYEV, V. P., candidate of technical sciences, senior scientific associate, and IVANOV, S. S., junior scientific associate. All from the Institute of High Temperatures, USSR Academy of Sciences

[Abstract] An experimental study was made of partly stabilized composite superconductor wires structurally almost homogeneous, for the purpose of determining their current capacity and its dependence on their size. A twisted multistrand wire of Nb-Ti alloy had been prepared for this study at the All-Union Scientific Research Institute of the Cable Industry (Moscow oblast). The basic first test specimen was a single wire of 18 superconductor strands, outside diameter 0.3 mm. In the second specimen 6 such wires formed a layer around a copper wire of the same diameter at the center (outside diameter 0.96 mm), in the third specimen another layer of 12 such wires was added around the first layer (outside diameter 1.54 mm), and in the fourth specimen a total of 108 such wires surrounded a core of 25 copper wires (outside diameter 4.6 mm). For adding mechanical strength and reducing losses in alternating magnetic fields, the superconductor strands were soldered with an indium alloy having a low melting point and a higher electrical resistivity, prior to the impregnation with epoxy compound. Measurements were made with the specimens inside a solenoid. The intensity of the external magnetic field was raised until the current induced in the superconductor specimen had reached its critical value corresponding to a loss of superconductivity and began to drop fast, whereupon the magnetic field was held constant until the specimen cooled down sufficiently to recover its superconductivity and then raised further until the current had reached its new critical value at this higher magnetic field intensity. With the magnetic field intensity lowered, the current in the superconductor specimens reversed directions. A superconducting solenoid with a 90-mm bore and a maximum magnetic induction of 5 T at the center served as a source of an external magnetic field and transport current. The current was measured with Rogowski loops. Heat transfer during measurements could be regarded as adiabatic. The results of measurements and calculations reveal

that the current density in superconductor wire generally decreases with increasing size. This is attributed to the dependence of the critical current on the intensity of the intrinsic magnetic field, produced by the current in the superconductor, as well as to the lower thermomagnetic stability of larger superconductors. Figures 2; tables 1; references 5: 2 Russian, 3 Western.  
[288-2415]



UDC 621.313.333:531.65:62-501.222

# DESIGN OF KINETIC STORAGE OF ELECTRIC ENERGY

Moscow ELEKTRICHESTVO in Russian No 6, Jun 83 (manuscript received 20 Nov 8?)  
pp 31-37

LEDOVSKIY, A. N., candidate of technical sciences, Moscow

[Abstract] A kinetic set for storage of electric energy contains in general a flywheel absorbing energy from the mechanical drive and delivering it to the electrical load. Involved here are primary conversion of electrical energy to mechanical and of mechanical energy to electrical as well as secondary conversion of one form of electrical energy to another, a.c. to d.c. to a.c. An automated design system for such an energy storage set must be compatible with the design of electric motors and generators. Its modular-hierarchical structure will ensure independence of calculations for individual components with maximum accounting for interdependence of components. It combines, in a most rational manner, automatic and automated design with manual operations. It uses a unified data base with maximum utilization of standard programs. The design process is divided into three stages: 1) Conceptual synthesis; 2) Structural synthesis and assembly; 3) Parametric design with optimization of parameters by the digital computer operating in the batching mode and with subsequent engineering-drafting documentation. The organization of such an automated design system is examined, considering that the energy storage set is a part of a larger system such as an automobile or other vehicle. Minimum mass is in this case generally selected as an optimality criterion, with cost and energy economy also taken into consideration. The automated design system contains four types of modules. Problem modules constitute essentially the mathematical models of storage set components, including synthesis modules as well as preliminary and final analysis modules. Invariant modules contain decks of application programs. Structural modules contain trees of design calculations and informative modules contain reference data on materials and catalog data on stock items. The operation of this design system is demonstrated on an energy storage set which includes two stages of energy conversion: d.c. to a.c. by means of an inverter with either pulse-width-modulation or relay-type voltage and frequency regulation, usually including transformers and rectifiers. A flywheel rated for 1 MJ energy and 3 kW power is considered with induction motor and inductor alternator, or with induction motor-generator, or with rectified motor-generator drive (synchronous machine with rectified-current exciter). Calculations and analysis of the results indicate that a rectified motor-generator drive with  $\text{CmCo}_5$  permanent magnets yields an energy

storage set with optimum weight and size characteristics. Subsequent performance calculations include temperature rise in machine. The accuracy and reliability of these calculations is within 10-11%. Figures 4; references: 17 Russian.  
[292-2415]

## MAGNETICS

UDC 621.317.785.025

### METHODS OF DESIGNING POLE SHIELD OF A.C. ELECTROMAGNETS

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 5, May 83 (manuscript received 23 Jun 81) pp 69-73

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[Abstract] The design and optimization of a shield for an a.c. electromagnet, usually a short-circuiting turn, is a problem which has not yet been definitively solved. Here known methods are reviewed critically, among them solutions based on constant mmf, constant flux-linkages, minimum pole force, or optimum normalized electrical resistance and various approximations of the magnetization characteristic. Included are methods involving simulation of physical models on an analog computer. The analytico-experimental approach is regarded as the most interesting and appropriate. It is suggested that proper accounting for saturation and nonsinusoidality of magnetic induction as well as for anisotropy of electrical steels will eventually be incorporated into an accurate and simple design optimization procedure, probably with the use of nomograms. References 31: 21 Russian, 1 Czech, 4 Romanian, 5 Western. [288-2415]

UDC 681.527.83

### EQUIVALENT CIRCUITS OF MAGNETIC SUSPENSION DEVICES

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in Russian No 5, May 83 pp 86-91

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[Abstract] Electrical equivalent circuits are constructed for various non-electrical components of magnetic suspension systems. Basic to such devices are a vertical thrust bearing with axial compensation and a bilateral horizontal

thrust bearing, both using permanent magnets. Auxiliary devices considered in this paper include a pair of permanent magnets for rotor stabilization and a pair of a.c. electromagnets with capacitors in series with the windings for rotor centering by the resonance method. The procedure for deriving the electrical equivalent circuit from the mechanical analog is extended to a simple electromagnetic suspension system with external stabilization through feedback control also acting as a vibration damper. Figures 10; references 3: 2 Russian, 1 Western (in translation).  
[288-2415]

FLOW OF CONDUCTING LIQUID THROUGH GAP OF HOMOPOLAR ASYNCHRONOUS D.C.  
ELECTRIC MOTOR

Novocherkassk IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: ELEKTROMEKHANIKA in  
Russian No 5, May 83 pp 33-41

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[Abstract] A homopolar asynchronous electric motor with ring electrodes and perfectly hermetic liquid-metal contact is considered in the general case of the liquid metal flowing through the gap, around the rotating inductor, in an axial electric field and a radial magnetic field with a constant component as well as an alternating one. Laminar axisymmetric steady-state flow in the outer layer adjacent to the lateral surface of the inductor is analyzed on the basis of the generalized Ohm's law and the fundamental differential equations for azimuthal velocities, with appropriate boundary conditions and a constant d.c. voltage applied to the electrodes. The inductor is assumed to rotate independently of the liquid and at constant velocity. The calculations are generalized by introduction of the Hartmann number. Numerical results are given for comparison with experimental data on a motor with 0.2 V across the electrodes in the flow chamber and with mercury as the contact liquid. Figures 4; references 7: 6 Russian, 1 Czech (in translation). [288-2415]

NEW ACTIVITIES, MISCELLANEOUS

UDC 621.313.291.045:538.311.001.24

METHOD OF CALCULATING ELECTROMAGNETIC FORCES ON INDUCTOR OF CRYOGENIC  
HOMOPOLAR MACHINE

Moscow ELEKTRICHESTVO in Russian No 6, Jun 83 (manuscript received 5 Oct 82)  
pp 59-61

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[Abstract] For the design of cryogenic homopolar electric machines, a precise method of calculating the forces on the field winding is proposed which yields both radial and axial force components with an error not exceeding 5-8%. The machine is regarded as an axisymmetric structure so that the problem can be reduced to a two-dimensional one in a cylindrical system of coordinates. The magnetic induction and the magnetic field intensity need to be evaluated in only one meridional plane, which is done first without and then with the effect of the ferromagnetic (steel) housing material taken into account. The array of winding turns is replaced with equivalent layers of magnetic charges, the entire space being subdivided into inter-layer regions and the remaining exterior region. Calculations are performed by the method of secondary sources, with the nonhomogeneous medium reduced to a homogeneous one by introduction of volume charges and with the problem reduced to a Fredholm nonlinear integral equation of the second kind for charge density. The solution, which involves evaluation of complete elliptic integrals, has been programmed so as to include SPLIN and SEVAL interpolation subroutines with a cubic spline. Typical results have been obtained for a field coil carrying a current of  $9.52 \cdot 10^6$  A and a core made of electrical-grade 10864 steel. They include not only the distribution of force but also the distribution of the magnetic field over a coil cross section, both distributions being critical to a proper design. Figures 3; references 6: 3 Russian, 3 non-Russian (2 in translation). [292-2415]

CSO: 1860

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